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A NEW SUBSPECIES OF RAT SNAKE (GENUS *ELAPHE*), AND NOTES ON RELATED FORMS

By Wilfred T. Neill

For many years I have been collecting specimens of *Elaphe*, intending to revise at least the *obsoleta* and *guttata* groups. Recently, Mr. E. Ross Allen, well-known naturalist of Silver Springs, Florida, has joined the project, and our joint observations are nearly ready for press. In the meantime I wish to describe a new subspecies, and I propose to name it in honor of Mr. Allen, for it was his assiduous collecting which focused attention on the form (and on numerous other Florida novelties as well). The new form may be called:

ELAPHE OBSOLETA ROSSALLENI new subspecies

TYPE. WIN No. 18,881; adult male collected July 11, 1947, by Wilfred T. Neill.

TYPE LOCALITY. 22 miles northwest of Fort Lauderdale, Broward County, Florida (near junction of State Highways 25 and 84).

PARATYPES. Sixteen, from the following localities: Lakeport, Glades County; 10 miles west of Lake Worth, Palm Beach County; 18 miles west of Fort Lauderdale, Broward County; about 20 miles northwest of Miami, near Dade-Broward County line; 14 miles north of Miami, Dade County; northern Collier County near Immokalee; extreme southern tip of Sarasota County, Florida. Specimens from Hendry, Lee, Charlotte and northern Monroe counties have been examined but not designated as paratypes. Numerous *rossalleni-quadrivittata* and *rossalleni-deckerti* intergrades have also been studied.

DIAGNOSIS. A large snake allied to *E. obsoleta quadrivittata;* ground color of adults rich orange, orange-yellow, or orange-brown; dorsal and lateral stripes present but not sharply defined, of a dull gray-brown

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shade; a vague sublateral stripe, evident posteriorly, on the tips of the ventrals; chin and throat bright orange; venter bright orange or orange-yellow; scales with a glaucous sheen, at least anteriorly; iris orange; tongue bright red. The diagnostic coloration is assumed at an early age; the smallest specimen examined, 605 mm. total length, was readily identifiable as *rossalleni*.

In *E. o. quadrivittata*, the ground color varies from light gray (near the region of intergradation with *E. o. obsoleta*) through yellow-gray to clear yellow or tan; the stripes are blackish, narrow, and well-defined; a sublateral stripe is occasionally evident; the chin and throat are white; the venter is whitish, mottled with gray posteriorly; the scales lack a glaucous sheen; the iris is gray or yellow; the tongue is black. Some trace of juvenile spots is often retained until the individual is quite large.

In *E. o. deckerti*, the ground color is a dull yellow with a brown or olive suffusion of variable intensity; the stripes are blackish, narrow, and well-defined; a sublateral stripe is better defined than in *rossalleni*; the chin and throat are yellow, often with a large white gular patch; the venter is pinkish, flesh, or tan, occasionally spotted with orange-yellow; the scales lack a glaucous sheen; the iris is pink or red; the tongue is black. Usually some trace of dorsal spots remains evident throughout life. *Deckerti* is smaller than either *quadrivittata* or *rossalleni*.

DESCRIPTION OF TYPE. Rostral wider than high, notched below for passage of the tongue. Nasal divided, the large nostril centered between an anterior and a posterior half. Loreal trapezoidal, longer than high. One large preocular, two small postoculars. One long, lower anterior temporal, separated from the parietal by two small, horizontally aligned upper temporals; behind these scales, three small temporals in a vertical row. Internasals two, each about one-third the size of a corresponding prefrontal. Frontal slightly longer than wide, subtriangular, the apex of the triangle directed posteriorly. Supraoculars slightly longer than wide. Parietals about one and a half times as long as frontal. Supralabials 8, the seventh and eighth subequal on the left side, the seventh largest on the right side, the fourth and fifth in cantact with the eye. Infralabials 11, the first from each side meeting each other just behind the mental; the sixth largest. A pair of large chin shields in contact on the midline; behind them, a second pair separated by two pairs of small scales.

Scale rows 27 on neck and anterior portion of body; 25 near midbody; 23 a little posterior to midbody; 21 at a point about 50 cm anterior to the level of the vent; 19 at a point about 13 cm anterior to the vent; 17 immediately anterior to the vent. Anteriorly, the first 8 scale rows smooth; at midbody, 4 or 5 rows smooth; at level of vent 1 row smooth. Other scales weakly keeled. Dorsal scales with 2 apical pits which are scarcely evident to the naked eye.

Ventrals 236; anal divided; subcaudals 93, divided; tail terminating in a long spine which is grooved along the midline above.

Form moderately stout. Head length 46 mm; snout-vent length 1518 mm; tail length 342 mm.

Dorsum bright orange in life. A vaguely defined gray-brown stripe, about 2 scale rows wide, on each side of the midline, beginning just behind the head and extending nearly to the tip of the tail. A similar stripe on each side, separated from the ventrals by 1 scale row posteriorly and 2 rows anteriorly. Dorsal stripes separated by about 3 scale rows. Head mustard yellow tinged with orange. Chin and throat brilliant orange-yellow with an elongate white spot along the midline. Labials brilliant orange-yellow. Venter bright orange anteriorly, becoming rich chrome yellow posteriorly. Tips of ventrals posteriorly with a faint brownish tinge; venter otherwise immaculate. Under surface of tail chrome yellow. Iris of eye orange; tongue bright red.

VARIATION. Males and females apparently differ little in ventral count. Females display a lower subcaudal count, averaging about 84. Occassional examples are completely suffused with a deep reddish or orange which obscures the stripes. On the northern border of its range, *rossalleni* shades into *quadrivittata*, and on the southern border into *deckerti*. Within the range given below, *rossalleni* consistently displays its diagnostic features.

RANGE. Northern Monroe and Dade counties; Collier, Broward, Palm Beach, Hendry, Lee, Charlotte, and Glades counties; extreme southern Sarasota County; and probably Martin County, Florida. Through the courtesy of Mr. Allen I have been able to examine living specimens from all the above counties except Martin.

HABITAT. Moist or swampy areas; moist hardwood hammocks; river swamps; "glade-land"; grassy "prairies"; salt marsh. Although often arboreal, *rossalleni* is not confined to wooded areas, often occurring in treeless marshes.

DISCUSSION. A summary of findings, to date, in the *Elaphe obsoleta* and *E. guttata* groups, appears to be necessary to an understanding of the phylogenetic position of *rossalleni*. The study is not complete, although 1,112 specimens have been examined. In the following account, all observations refer to adult specimens, examined by me, unless otherwise noted. I am indebted to Mr. Allen, not only for material, but for permission to publish, under my own signature, an advance summary of certain findings which should rightly appear under our joint signatures.

OBSOLETA. *E. obsoleta*, the black rat snake, ranges from extreme eastern Texas (Bowie County) northward through the higher areas to the west and northwest of the Mississippi Valley, occurring in western Arkansas, southeastern Nebraska, and Minnesota. It ranges thence eastward to Massachusetts, southern Ontario, and southward to Georgia. Specimens unquestionably referable to *obsoleta* occur as far south as the southern border of the Fall Line Hills, in the upper Coastal Plain of eastern Georgia and western South Carolina (Neill, 1947a: 207).

OBSOLETA-QUADRIVITTATA INTERGRADES. In the Fall Line area of Georgia and South Carolina are found occasional adult *obsoleta* with well-developed stripes on a ground color somewhat lighter than usual. Such specimens formed the basis for Cope's subspecies *leamiscatus*, which he char-

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acterized as being intermediate between *obsoleta* and *quadrivittata* (Cope, 1900: 849). I have collected 22 rat snakes of this type within a 15-mile radius of Augusta, Richmond County, Georgia. Thoroughly black examples are occasionally found as far south as southern Burke County, Georgia, about 30 miles below the Fall Line. About 40 to 50 miles below the Fall Line, in Screven and Emanuel counties, Georgia, and Allendale County, South Carolina, the rat snakes are somewhat lighter, with well-defined stripes and a row of dorsal spots. These specimens are exactly intermediate between *obsoleta* and *quadrivittata*. The intergradient type occurs everywhere that the ranges of *obsoleta* and *quadrivittata* meet; *i. e.*, from northern North Carolina to Central Georgia, in the Coastal Plain. I have collected 31 adults of this type at scattered points in eastern Georgia and western South Carolina; a specimen is also at hand from Columbus County, North Carolina. A single such intergradient specimen from Carteret County, North Carolina, evidently afforded the basis for the description of *E. quadrivittata parallela* (Barbour and Engels, 1942; 103). The type differs in no way from Georgia-Carolina intergradient material. The name *parallela* is to be relegated to the synonymy along with *leniscatus*. About 60 to 70 miles below the Fall Line, in Bulloch, Emanuel, and Effingham counties, Georgia, and northern Hampton County, South Carolina, the rat snakes begin to show yellowish on the dorsum, and the lineate pattern is pronounced. I have collected 9 such adults in Georgia and 4 in South Carolina. Farther south, the rat snakes are referable to *quadrivittata*. The *obsoleta-quadrivittata* cline is smooth and regular—an unambiguous instance of intergradation. Thus the black rat snake is to be known as *Elaphe o. obsoleta* and the yellow rat snake as *E. o. quadrivittata*.

QUADRIVITTATA. *E. o. quadrivittata* ranges from the lower Coastal Plain of the Carolinas southward into Florida and westward into the Gulf Coastal Plain. The Checklist gives the range as extending west to the Mississippi (Stejneger and Barbour, 1943: 138). This merely follows the statement of the original describer (Holbrook, 1836: 113). Apparently Holbrook's statement was an assumption. Authentic records from Alabama and Mississippi are lacking. Haltom omitted *quadrivittata* from his account of Alabama reptiles (1931); Löding listed it following Holbrook, but commented, "Alabama records: None" (1922: 29). Alabama collectors of my acquaintance have been unable to find it in their state. Mr. Allen (who has probably collected in the Southeast more extensively than anyone else) was able to find the form no farther west than Leon and Gulf counties, Florida. The latter locality represents the western limit of the range, so far as is known. The form is lacking throughout most of the western portion of the Georgia Coastal Plain.

In Florida, *quadrivittata* was taken in St. Johns, Alachua, Dixie, Levy, Marion, Volusia, Hernando, Pinellas, Polk and Manatee counties; there are literature records for other localities within this general range (Carr, 1940: 82). The form extends farther south coastally than inland, and seems rare in much of western Florida north of Homosassa.

QUADRIVITTATA-ROSSALLENI INTERGRADES. Along the southern border of its range, *quadrivittata* takes on a deeper coloration, assuming shades

of light orange-yellow. These specimens mark the beginning of the trend toward *rossalleni*. Living specimens of this type were examined from Sarasota and DeSoto counties; coastal Charlotte County; extreme northwestern Lee County; and southern Highlands County, Florida.

ROSSALLENI. The new subspecies ranges from Highlands and DeSoto counties southward to northern Monroe and Dade counties. Florida, as noted under "Range".

These bright orange snakes have been known for some time. Mr. Allen has long listed them in his catalog as "Everglades rat snakes". Probably no one has questioned that they are distinct from *quadrivittata*. Carr (1940: 82) suggested that they might be included with *deckerti*; but apparently he was not satisfied with this disposition, for later he and Barbour stated that they might be worthy of a name, since they did not constitute graded intermediates between *quadrivittata* and *deckerti* (Barbour and Carr, 1940: 339). Brady apparently intended to exclude the reddish or orange rat snakes from his description of *deckerti* (Brady, 1932: 5). Actually, *rossalleni* is a well-defined form, consistently displaying its diagnostic features over an extensive range.

ROSSALLENI-DECKERTI INTERGRADES. In northern Monroe and Dade counties, Florida, the rat snakes become duller in coloration dorsally and ventrally. The red tongue of *rossalleni* developes irregular spots of black; the rich coloration of *rossalleni* fades to a dull yellow or becomes suffused with dingy brown or olive. The venter becomes tannish. Intergrades closer to *rossalleni* were examined from the following localities: Miami; 14 miles west of Miami; 20 miles west of Miami; Paolita Seminole village. Intergrades closer to *deckerti* were examined from these localities: 21 miles south of Miami; Kendall; Paolita village.

DECKERTI. Much of the confusion surrounding *deckerti* is due to the fact that Brady's material (insular examples from the extreme limit of the range) was not particularly typical; and most subsequent reviewers have quoted or paraphrased Brady's description. The ground color of *deckerti* is seldom orange, never the bright orange of *rossalleni*. In the material I have examined, the ground color was straw, tan, dull orange with a dingy brown suffusion, wood brown, or sepia. The lighter specimens are reminiscent of *quadrivittata*, but are much less attractive. Some examples are nearly as dark as *obsoleta*. The stripes are gray-brown, rosy brown, or blackish, better defined than in *rossalleni*. Usually dorsal spots are distinct. The venter is tan, flesh, or dull orange, often brighter on the chin and throat. The venter may be suffused posteriorly with a pale gray which breaks up into tessellations anteriorly, leaving the ventral ground color to appear as light spots. This condition is infrequent in mainland examples. A sublateral stripe is present posteriorly. The iris is pinkish-orange or red. The tongue is black, even in lighter examples.

I suspect that the topotypical Lower Matecumbe Key population was slightly aberrant, as is very frequently the case with isolated Key populations. Unfortunately, we may never know whether this is true. During recent hurricanes, the ocean completely covered the island. Mr. Allen and his collectors have been unable to secure specimens there in

recent years. During the summer of 1947 I visited the island, collecting *Hyla squirella* but no *Elaphe*. A single topotype collected in 1940 differed from mainland *deckerti* in displaying sharply defined dorsal spots and gray mottling on the posterior portion of the venter.

On the mainland *deckerti* is fairly common. Many specimens were taken along U. S. Highway 1 south of Miami, from Princeton to Key Largo. Others were taken along State Highway 205, between Florida City and East Lake (near Cape Sable). Nineteen living specimens were examined.

Carr's suggestion, that *E. rosacea* might be a derivative of *deckerti*, is untenable, as will be shown later (cf. Carr, 1940: 83).

It is evident that a well-defined chain of subspecies exists. *Deckerti*, displaying as it does a specialized pattern, and occupying the geologically most recent territory, is evidently a derived form or end-product. Thus the line of descent is from western *obsoleta* to eastern *obsoleta*, to *quadrivittata*, to *rossalleni*, and thence to *deckerti*. *Obsoleta* shades smoothly into *quadrivittata*, the latter into *rossalleni*, and *rossalleni* into *deckerti*. Thus all these forms are to be listed as subspecies of *E. obsoleta*.

Since *E. confinis* is usually considered a subspecies of *obsoleta*, it and the closely similar *williamsi* must be considered.

CONFINIS. Excluding temporarily certain Texas specimens, the gray rat snake ranges from Louisiana northward through the Mississippi Valley, filling in the territory not occupied by *obsoleta*. It also ranges eastward in the Gulf Coastal Plain to northwestern Florida, and is said to reach the Carolinas. The Florida range will be considered first. *Confinis* was collected in Walton, Gulf, Liberty, Wakulla, and Leon counties, in the Florida Panhandle, and also farther east in Suwanee and Union counties. In this direction it reaches the southwestern border of Okefinokee Swamp. Carr (1940: 82) lists it from Levy and Marion counties but these (old literature?) records are doubtful. Marion County has been a base of operations for Mr. Allen and his collectors for years, and they have failed to find it there or in adjacent Levy County.

Two types of *confinis* occur in northwest Florida. One is marked with gray-brown spots on a pale gray-brown ground. This form ranges westward to Louisiana. The other displays silver-gray or dark gray spots on a floury, whitish ground. The latter form ranges from northwest Florida northward into the west Georgia Coastal Plain, and drives a wedge into *obsoleta* territory along the Fall Line Hills. Both phases were taken by Mr. Allen in Gulf County, Florida.

The whitish eastern form of *confinis* occupies a less extensive range than the literature indicates. It follows the Fall Line Hills eastward to Aiken and Barnwell counties, South Carolina. I doubt that it ranges much farther east. Corrington (1929: 73) reported it near Columbia, South Carolina; but his account of its habit and habitat suggests that he did not have true *confinis*. I have examined supposed *confinis* from North Carolina and from the Georgia Piedmont; such specimens always proved to be *obsoleta* that had retained some trace of the juvenile coloration longer than usual. I feel certain that *confinis* does not enter the Piedmont.

The type locality of *confinis* was said to be Anderson, South Carolina (Baird and Girard, 1853: 76). I previously pointed out that the form does not occur at Anderson; but that much of the Payne material (which included the type of *confinis*) was obviously collected in the Coastal Plain and merely shipped from Anderson (Neill, 1947b: 76). I also noted that the type, if extant, would be unidentifiable, since it was a very young specimen. The name *confinis* is tenable if we assume the type locality to be unknown. Obviously this is the desirable course to follow.

WILLIAMSI. In many respects *E. williamsi* is intermediate between *confinis* and *quadrivittata*. One might suspect that these snakes were the result of genetic intercourse between gray and yellow rat snakes, However, such is not the case. *Confinis-quadrivittata* intergrades do occur; they do not resemble *williamsi*.

The 3 type specimens of *williamsi* were from the Gulf Hammock portion of Levy County, Florida (Barbour and Carr, 1940: 342). There is no evidence that it occupies all the Gulf Hammock (a forested area about 15 miles wide, extending down the west coast of Florida from Levy to Pasco County). It is not restricted to the Hammock in Levy County; specimens were collected in the eastern portion of the county. Mr. Allen also secured a specimen in southwestern Alachua County, and suggests that the Levy and Marion County records of *confinis* may have been based on *williamsi*.

Confinis and *williamsi* are known from adjoining counties (*confinis* from Union and *williamsi* from Alachua County). The two forms can be distinguished by no morphological feature, and both display a whitish ground color and dark markings. In many eastern *confinis*, a lateral stripe is well developed along the entire length of the body. A dorsal stripe is often evident on the neck, and sometimes on the entire anterior half of the body. Furthermore, the more northern specimens of *williamsi* display short stripes, thus closely approaching *confinis*. The gap between the two forms is virtually bridged. I believe that *williamsi* is a derivative of the closely similar *confinis*, replacing it geographically; and that the two are conspecific. Further evidence of intergradation should be found in the region between northern Alachua and southern Taylor County, Florida.

Eastern *confinis*, with reduced pigmentation, and *williamsi*, with well-defined stripes, seem more specialized than the darker, spotted and mottled western *confinis*. Probably western *confinis* gave rise to both *williamsi* and eastern *confinis*.

Thus two lines of descent trace back toward Texas: the *obsoleta* line to extreme northeastern Texas, and the *confinis* line to extreme eastern Texas. It is pertinent to inquire as to whether a common ancestor of both lines occurs in east Texas.

LINDHEIMERI. The east Texas rat snake, *E. o. lindheimeri*, fulfills all requirements for a common ancestor of *obsoleta* and *confinis*. *Lindheimeri* is marked with blackish blotches on a ground color of mottled gray and white. The skin between the scales is often pink or yellow. The head is black with whitish supralabials. An increase in dark pigment

would result in an animal similar to *obsoleta*, a decrease in dark pigment would bring about a condition similar to that of western *confinis*. Admittedly more study is needed. I have examined but 5 living *lindheimeri*, and 2 of these lacked good data. However, I have examined many *obsoleta* from Arkansas and Missouri; these showed definite approach to *lindheimeri* in pattern.

Stejneger and Barbour synonymized *linderheimeri* with *confinis* in the third edition of the Checklist (cf. Introduction to 3rd ed., reprinted in 4th ed., 1943: x); while Cope synonymized it with *obsoleta* (1900: 846). Ditmars long argued for its validity (1936: 232; 1946: 192); Conant and Hudson included it in a recent paper (1949:6). It seems to me fully as close to *obsoleta* as to *confinis*, but distinct from either.

It is significant that both lines of descent appear to trace back to Texas. This condition has been noted in most groups of North American snakes which have been studied from a phylogenetic standpoint. Dispersion from a Mexican Plateau (or Guatemalan Plateau) center is becoming well-nigh axiomatic in phylogenetic studies of North American snakes.

OBSOLETA-CONFINIS INTERGRADES. Extensive populations, intermediate between *obsoleta* and *confinis*, occur in Arkansas, southern Illinois, extreme southern Indiana, Kentucky, western Tennessee, Georgia, and South Carolina. I have examined intergrades from all these states. Along the Fall Line Hills, in Georgia and South Carolina, intermediate populations outnumber all others. In short, the two forms intergrade extensively wherever their ranges meet; and although there is occasional slight interpenetration owing to an ecological separation, the two are to be considered conspecific, even if the presumed connection through *lindheimeri* be disregarded. I have collected 107 *obsoleta-confinis* intergrades in the Fall Line Hills of Jefferson and Richmond counties, Georgia, and Aiken and Barnwell counties, South Carolina.

It has been my experience that, where *obsoleta* and *confinis* occur together, the former inhabits moist woods and damp meadows, while the latter is confined to dry woods and fields. The Fall Line Hills are eroded hills of sand or sandy loam, dry and sparsely vegetated—unsuitable for *obsoleta* but ideal for *confinis*. In this area *obsoleta* is rare, being restricted mainly to the major stream valleys. This circumstance has enabled *confinis* to invade *obsoleta* territory (always with the production of some intermediate populations).

The absence of *confinis* from swampy areas leads me to question Corrington's account of the form from Columbia, South Carolina (see above). In the Gulf Coastal Plain, where *confinis* does not compete with any other member of its group, it may occupy a wider variety of habitats. The intergradient specimens from Georgia and South Carolina were found near lakes and streams, and never in dry areas.

CONFINIS-QUADRIVITTATA INTERGRADES. The gray and the yellow rat snakes intergrade, albeit rarely, wherever their respective ranges meet. Such an intergrade is an odd-looking animal. Portions of the body are marked as in *confinis* and portions as in *quadrivittata*. The ground color is a mixture of gray and yellow, with spots and gray stripes. Such specimens are often large and heavy, suggesting hybrid vigor. I have

taken this type of snake along the western border of Okefinokee Swamp, and also in Allendale County, South Carolina. Mr. Allen presented me with a similar example from northwestern Alachua County, Florida. In the first two areas mentioned, I have also taken specimens with a fairly typical *confinis* pattern on a yellowish ground color. These intermediate specimens have been found only at localities where the ranges of *confinis* and *quadrivittata* meet.

The ranges of *confinis* and *quadrivittata* overlap slightly in northwest Florida (but apparently nowhere else). Mr. Allen and I have collected large numbers of both forms, and we are in accord that there is a strong ecological separation between them, *confinis* inhabiting dry fields and woods, *quadrivittata* preferring moist hammocks, swamps, and marshes. This habitat preference undoubtedly accounts for the slight interpenetration.

WILLIAMSI-QUADRIVITTATA INTERGRADES. A single specimen from Pinellas County, Florida (just south of the Gulf Hammock), is probably a *williamsi-quadrivittata* intergrade. It displays the following features: ground color light gray; 4 dark brown stripes along the entire length of the body, at midbody covering scale rows 3-4-5 and 10-11-12; a dorsal series of 35 saddles, formed by a broadening and confluence of the dorsolateral stripes; lateral stripes irregularly broadened at points alternating with the dorsal saddles; lateral stripe and dorsal spots evident on tail; a sublateral stripe on the tips of the ventrals; venter white with gray blotches that become more thickly clustered posteriorly; total length 1028 mm. Apparently *quadrivittata* is lacking or rare in much of *williamsi* territory.

PHYLOGENY. I conceive the phylogeny to have been as follows: the most primitive form, *lindheimeri* of east Texas, gave rise to *obsoleta* in the uplands. *Obsoleta* ranged northward around the Mississippi Valley and into the higher areas east of the Valley. On the Atlantic Coastal Plain it gave rise to *quadrivittata*, which ranged thence southward, avoiding the Coastal Plain of western Georgia and northwestern Florida. In south-central Florida, *quadrivittata* gave rise to *rossalleni* and the latter, in extreme southern Florida, produced *deckerti*. *Lindheimeri* also gave rise to western *confinis* in the lowlands. *Confinis* ranged through the Mississippi Valley, filling in the territory unoccupied by *obsoleta*. *Confinis* also pushed eastward along the Gulf Coastal Plain, and in northwest Florida produced two forms: eastern *confinis*, which filled in the western Georgia Coastal Plain, and *williamsi*, which filled in the northwest coast of Florida. Thus, in the main, all these forms occupy mutually exclusive ranges (and intergrade more or less extensively along each common boundary). *Confinis* has invaded *obsoleta* territory along the Fall Line Hills; *quadrivittata* has invaded *confinis-williamsi* territory in northwest Florida. In each case the interpenetration is explainable by the different habitat preferences of the forms involved. *Quadrivittata* is rare in *confinis-williamsi* territory; *confinis* is excessively rare in *obsoleta* territory (contrary to the statements of some authors).

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It is conceivable that western *confinis*, eastern *confinis*, and *williamsi* are lineally related; but geographic considerations suggest that the last two are independent derivatives of the first.

Two forms, *lindheimeri* and *williamsi*, need study on the basis of much more material than is now available. Even without *lindheimeri*, there is sufficient *obsoleta-confinis* intergradation to connect the two lines of descent. *Quadrivittata, rossolleni, deckerti, lindheimeri, confinis,* and *williamsi* are all subspecies of *E. obsoleta*. Both *obsoleta* and *confinis* may eventually be split into eastern and western populations.

GUTTATA. The *E. guttata* group is readily distinguished from the *obsoleta* group by the presence of a shorter tail, lower subcaudal count, reduced carination, smaller size, different scale count, and many other features. *Guttata* need not be considered, but *E. rosacea* requires mention.

ROSACEA. This rat snake is obviously a close relative of *guttata*, the two agreeing in general form, size, short tail, subcaudal count, reduced carination, general pattern, etc. Carr's suggestion that *rosacea* might be a derivative of *deckerti* is thus untenable. Specimens of *guttata* decidedly resembling *rosacea* are occasionally found even in north Florida, and are common in south Florida. At about the level of Homestead, Dade County, Florida, occur specimens intermediate between *rosacea* and *guttata* in dorsal blotch width, longitudinal extent of lateral blotches, carination, distinctness of nuchal chevron and ventral tessellation, etc. *Rosacea* is a subspecies of *E. guttata*. Intermediate examples probably formed the basis for Cope's *Coluber guttatus sellatus*, which he characterized as being "evidently annectent to the *C. rosaceus*" (1900: 836). Contrary to some statements, typical *guttata* is lacking on Key West. Intergrades are found on the upper Keys as well as on the mainland.

HYBRIDS. No *obsoleta-guttata* hybrid has been seen. *Quadrivittata-guttata* hybrids occur in Florida occasionally; I have collected 3 such specimens. These animals were marked dorsally like *guttata*, but the dorsal spots were reddish-orange. The lateral spots were blurred and streaked longitudinally. The nuchal chevron and ventral tessellations were evident but less distinct than in *guttata*. A single *guttata-rossalleni* hybrid was taken. It displayed the coloration of *rossalleni*, intensified by a reddish suffusion and crimson dorsal spots. Lateral spots were suggested, but were much streaked and blurred. An indistinct nuchal chevron and blurred ventral tessellations were evident. These 4 hybrids were all larger than the usual *guttata*, agreeing more closely with the *obsoleta* type in morphology. Certain literature descriptions suggest that *rosacea-deckerti* hybrids exist; but I have been unable to find such an animal. Both *rosacea* and *deckerti* occur (or occurred) on Lower Matecumbe Key.

The hybrids exist only as rare, isolated individuals, of sporadic and unpredictable occurrence. No hybrid population exists. The occasional hybridization should not affect the taxonomy of the 2 species.

No effort will be made to present tables of scale data, etc., in this paper. However, it may be mentioned that, at present, no morphological

character has been found that will consistently distinguish one subspecies of *obsoleta* from another, adjacent subspecies. Ventral and subcaudal counts, scale row counts, degree of carination, and hemipenial characters will distinguish western or northern *obsoleta* from geographically remote southeastern *obsoleta*, but will not distinguish southeastern *obsoleta* from eastern *confinis* or Georgia *quadrivittata*. *Williamsi* overlaps *confinis* and *quadrivittata* in morphological features; *lindheimeri* overlaps *obsoleta* and *confinis*. Only slight average differences are evident between *quadrivittata* and *rossalleni*, or between the latter and *deckerti*, in characters of scalation. The various forms are best distinguished by adult pattern and coloration. This circumstance bears out the contention that all members of the *obsoleta* group are conspecific.

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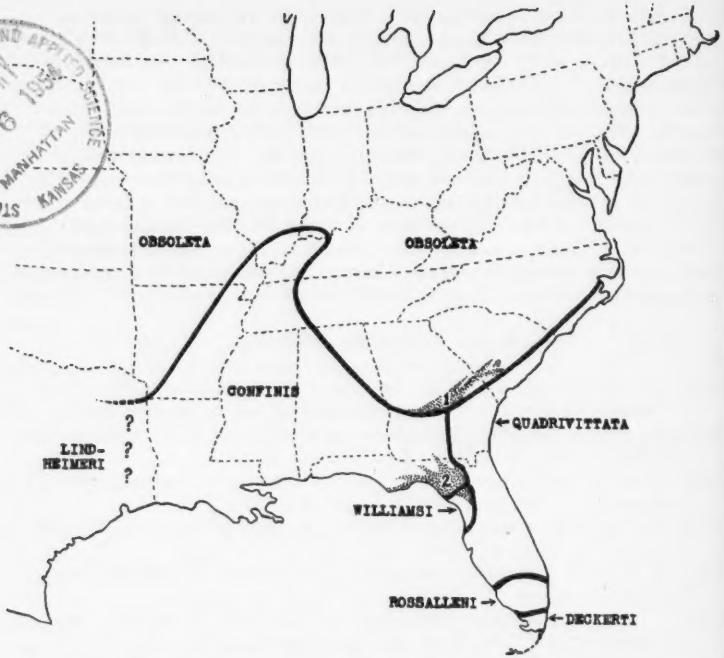

FIG. 1. Ranges of the subspecies of *Elaphe obsoleta*. More or less extensive intergradation occurs along every common boundary. The stippled area marked "1" is the region of *confinis-obsoleta* interpenetration; that marked "2" is the region of *quadrivittata-confinis* and *quadrivittata-williamsi* interpenetration. The geographical limits of *lindheimeri* are uncertain.